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(54) Machine-pluggable electronic package having a mechanical interlock.

(57) A machine-pluggable electronic package containing electronic components and having a mechanical interlock. The package (14) includes a first connector (32) to be connected with a connector mounted on the machine (10). The connection of the package (14) to the machine (10) is achieved by slidably inserting the package (14) along guiding means into a cavity in the machine (10). The package includes a second connector (35) to be connected with an connector outside of the machine (10) and the package (14). The package also includes a lever (38) pivotably mounted on a pivot (41) secured to the package (14), and having a handle (39) with tooth elements (42,43) intended to selectively cooperate with a rail (51) of the cavity in the machine (10). Clockwise rotation of lever (38) forcibly engages tooth (43) with rail side (52) thus locking the package in the cavity and connecting connectors (32,54). The reverse rotation unlocks the package and disconnects the connectors (32, 54), but is only possible when no outside connector is secured to the package.

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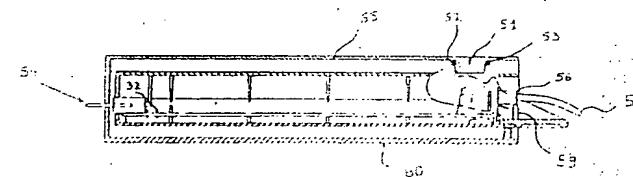


Fig. 5

MACHINE-PLUGGABLE ELECTRONIC PACKAGE HAVING A MECHANICAL INTERLOCK

Technical field of the invention

The present invention relates to machine electrical connection and more particularly relates to a device for facilitating the connection and the locking of a package, including electronic components, to a machine.

Background art

The prior art is replete with devices facilitating the electrical connection of a package, or a circuit card to be base machine. A typical example of such a device is shown in an article by G.J. Clair in IBM Technical disclosure bulletin (Vol. 27 N° 6 November 1984 pages 3536-3538), where is disclosed an enclosure designed to carry a circuit card and to provide easily applied force for plugging, unplugging and securing the card in place by simple lever action, and without the use of any tool.

The prior art also discloses electrical interlocks to prevent the removal of the cover of a machine without turning off the power and unplugging the device from the power source, notably a wall socket etc.. EP-A- 176676 discloses an electrical interlock which insures that the power cord is removed from the machine before a functional package, containing electronic components, can be removed or inserted into the machine.

However, the prior art does not disclose a simple device which both allows an easy plugging and unplugging of a functional package containing electronic components, and requires that any electrical conductor such as a power cord or a telecommunication cable be removed from the machine before the functional package can be removed or inserted in the machine.

Summary of the Invention

It is an object of the invention to provide means facilitating the insertion and the removal of a functional package containing electronic components in an electronic machine.

It is an other object of the invention to provide a simple device for locking the functional package into the electronic machine.

It is further object of the invention to provide a simple device insuring that the telecommunication cable is removed from the machine before the

functional package can be removed or inserted into the machine.

The objects of the invention are achieved by means of the machine-pluggable electronic package of the invention. The package includes a first connector means to be connected with connector means mounted on the machine. The connection of the package of the invention to the machine is carried out by slidably inserting the package along guiding means the machine. The package also includes a second connector means to be connected with conductor means outside of said machine and said package, and a lever pivotably mounted on pivot means secured to said package. The lever has a handle and associated first and second locking means, which are intended to selectively cooperate with third and fourth locking elements in said machine. The pivot means are located such that said first locking means forceably engages said third locking means upon rotation of said lever in a first direction, and located so that the second locking means forceably engages the fourth locking means upon rotation of the lever in a second direction opposite to the first direction, whereby rotation of lever in the first direction after insertion of the package along the guiding means, engages the first connector means with the connector means mounted on the machine. Conversely, rotation of lever in the second direction disengages the first connector means from the connector means mounted on the machine.

Description of the Drawings

Fig. 1 is a perspective view of a base machine adapted to receive the machine-pluggable electronic package of the invention.

Fig. 2a and 2b are two perspective views of the functional package of the invention showing respectively the front and the rear side thereof.

Fig. 3 is an exploded view of the different elements of the functional package according to the invention.

Fig. 4 is a cross sectional view of the functional package according to the invention taken along line 4-4 in fig. 2b.

Fig. 5 is a longitudinal sectional view of the functional package inside the recess of the cavity of the base machine.

Detailed Description of the Invention

To face with the increasing need of customers in highly sophisticated technology, while assuring a good deal of profit generated by mass production, electronic suppliers have a tendency to provide products in large quantities which products are nevertheless likely to satisfy numerous different requirements. For instance, in the field of telecommunication products, the concept of Integrated Services Digital Networks (I.S.D.N), resulting from the on-going process of digitalization of telephone networks, which process started in the early sixties, will provide in every customer's home the possibility of connection to the future network and thus will allow the customer to access large public telecommunications services. Therefore, telecommunication suppliers will have to market in large quantities, adapters designed to allow the I.S.D.N network connection for a large quantities of telecommunication Data Terminal Equipment (DTE) having different protocols and standards, such as V24, V35 or X21 standards as defined by the CCITT. Telecommunication product suppliers will therefore have to provide modular equipments, or functional packages, containing electronic components specific to particular protocols, and which when plugged into a base machine will allow the connection of a particular Data Terminal Equipment (for instance V35), to the I.S.D.N network. Since such products are marketed in large quantities and are intended to be used by general public, a need has appeared in a simple and low-cost device, allowing an user to easily insert and remove a functional package or a circuit card, while assuring a good protection of the electronic components inside the package against hot plugging or unplugging as well the protection of the user against electrical shocks.

Referring now to the drawings, and particularly Fig. 1 thereof, a machine, in the illustrated instance a telecommunication adapter designed to be connected to a digital network, is illustrated therein. As shown, the machine or I.S.D.N. adapter 10 has its rear side, cavities or recesses in which functional package 12, 13 and 14 can be housed. In an exemplary embodiment of the invention, each of functional packages 12 and 13 may contain electronic components mounted on a printed circuit board and allowing the connection of the machine 10 to a Data Terminal Equipment (DTE), not shown, by means of a cable 50, as illustrated in figure 5. Functional package 14 contains electronic components allowing the connection of the machine to a digital network. Two perspective views of a typical functional package are shown in figures 2a and 2b.

As shown in Fig. 3, each of functional packages 12, 13 or 14 includes a printed circuit board 31 on which are mounted electronic components. A

first connector 32, adapted to pluggably receive a male connector 54 (see fig. 5) secured to the base machine 10, is fixed to card 31, and allows the connection of the electronic components in the functional package to the components in machine 10. In an exemplary embodiment of the invention, the printed circuit board 31 is protected by a housing comprising a top cover 33 and a bottom cover 34 which are fixed together as by a screw 37. The printed circuit board 31 further includes a second connector 35, designed to connect the functional package to an outside equipment by means of cable 50. As will be understood by those skilled in the art, the nature of the components mounted on the printed circuit board 31, will determine the functional characteristics of the corresponding functional package and, hence, the type of equipment with which the package will be capable to be connected. A front plate 36 protects the rear side of the functional pack.

In accordance with the invention, each of the functional packages 12, 13 or 14 may be plugged into and removed from its associated cavity within machine 10 by means of a lever 38. As discussed in detail hereinafter, lever 38 is structured so that the magnitude of the force to be exerted by an operator to insert or remove the functional package is a small fraction of the magnitude of the force required to plug or unplug connectors 32 and 54. Without such an arrangement, the operator would have to exert a force of about 20 Newtons to connect or disconnect the package.

Lever 38 comprises a handle 39 designed to be operator grippable and, as shown in figure 3, two upwardly extending side arms 40, each connected at first end thereof to handle 39. Each arm 40 carries a laterally extending pivot stud 41, and is provided at its second end with two upwardly projecting tooth elements 42, 43. Each pivot stud 41 is received in the cooperates with a pivot aperture formed in the longitudinally extending side of the functional package housing. Preferably, each pivot aperture is obtained by machining, within the top and bottom covers, two semi-circular notches which, upon assembling the top and bottom covers together, will form a single circular aperture for receiving pivot stud 41.

Each tooth element 42, 43 is positioned with respect to its associated arm 40 and stud 41 so that, upon clockwise rotation (as shown in fig. 4) of lever 38 around studs 41, it will penetrate into an associated elongated aperture 45 formed within the top face of top cover 33, while during the same clockwise rotation, tooth element 42 will leave its associated aperture 44.

As best shown in fig. 5, the handle portion 39 of lever 38 is located with respect to connector 35 so that the presence of a connector plugged into

connector 35 will prevent the lever 38 from being rotated counter clockwise as shown in figure 5. It should be noted that that counter clockwise rotation brings the handle of the lever 38 to its upper position. For some type of small connectors 35, it may be necessary to provide handle portion 39 with a supplementary upwardly extending protrusion part 59 which, by engaging the connector body, will prevent the rotation of handle portion 39, while not preventing plugging and unplugging of the connector 56 and its cable 50.

Fig. 5 also shows that the cavity of machine 10 in which functional package 12, 13, 14 is received, is delimited by at least an upper wall 55 and a lower wall 60. Extending from upper and lower wall 55 and 60 are package guiding means which can take the form of channel means in which package 12, 13 or 14 can be slidably inserted. It should be understood that such channel means must be sized with respect to the dimensions of package 12, 13 or 14 so that they will permit only a longitudinal movement of the package within its cavity. Upper wall 55 is provided with a downward extending rail element 51. Rail element 51 extends transversely to the functional package guiding means. The height of rail 51 is such that its edges 52 and 53 interfere with tooth element 42, 43 of lever 38, unless the latter has been rotated to positions where the tooth elements 42, 43 will have cleared the edges of rail 51.

Referring to fig. 5, the operation of the device will be now described. The package is inserted into its associated cavity of machine 10 with lever 38 in its upper position, until tooth element 42 of lever 38 engages edge 53, at which time any further insertion of the package is prevented. At this point, lever 38 is rotated to its lower position as illustrated in figure 5. During the rotation, tooth element 43 first engages the lower corner of edge portion 52 of rail 51. Any further rotation of lever 38 will forcibly engage tooth element 42 with edge 52 and will create a torque which, in turn, will generate a longitudinal force. This force will further move the functional package within its associated cavity and will result in the plugging of connectors 32 and 54. Conversely, the removal of the package is achieved by rotating lever 38 towards its upper position. The engagement of element 42 with rail edge 53 will generate a torque which will assist in the extraction of the package from the machine 10 without requiring any substantial effort on the part of the operator.

When connector 54 is plugged into connector 32, a connector 56 may be plugged into connector 35 of functional package 14, assuring the connection of the machine to the digital network by means of a cable 50. However, since the insertion or extraction of this package in or out of the machine,

when the cable 50 is plugged, may cause the occurrence of voltage spikes due to excessive momentary loads. This may damage or destroy some internal components of the machine, or worst of all, injure badly the user. This problem is solved in the present invention by the presence of a protrusion 59, which prevents, as long as connector 56 remains plugged, the rotation of lever 38, and hence, the extraction of the functional package. Similarly, due to protrusion 59, the insertion of the package into the base machine can only be performed when male connector 56 is not plugged in its corresponding female connector plug 32. It should be understood that connector 56 and its cable 50 must be disconnected from the functional package 14 before same can be removed or inserted into the machine.

20 Claims

1. Machine-pluggable electronic package containing electronic components and having a mechanical interlock, said package (14) including a first connector means (32) to be connected with connector means mounted on said machine (10), the connection of said package (14) to said machine (10) being carried out by slidably inserting said package (14) along guiding means into machine (10),

characterized in that said package (14) further includes:

- a second connector means (35) to be connected with conductor means outside of said machine (10) and said package (14),

- A lever (38) pivotably mounted on pivot means (41) secured to said package (14), said lever (38) having a handle (39) and associated first (43) and second (42) locking means, said first and second locking means (43,42) intended to selectively cooperate with third (52) and fourth (53) locking elements, in said machine (10),

- said pivot means (41) located such that said first locking means (43) forceably engages said third locking means (52) upon rotation of said lever (38) in a first direction, and located so that said second locking means (42) forceably engages said fourth locking means (53) upon rotation of said lever (38) in a second direction opposite to said first direction, whereby rotation of said lever (38) in said first direction after insertion of said package (14) along said guiding means, engages said first connector means (32) with said connector means mounted on said machine (10) and locks said package (14) into said machine, and rotation of said lever (38) in said second direction disengages said first connector

means (32) from said connector means mounted on said machine (10) and unlocks said package (14) from said machine (10).

2. Machine-pluggable electronic package according to claim 1 characterized in that said lever (38) includes

- two upwardly extending side arms (40), each of said arms (40) carrying said first (43) and said second (42) locking means,

- each of said arms comprising a pivot stud (41) forming said pivot means and designed to cooperate with a pivot aperture formed in the longitudinal extending side of the of said functional package.

3. Machine-pluggable electronic package according to claim 2 characterized in that said package (14) includes a top cover (33) and a bottom cover (34) fixed together, each of the longitudinally extending side of said covers having two semi-circular notches forming, upon assembling said top (33) and said bottom (34) covers, a single circular aperture for receiving said one of said pivot stud (41).

4. Machine-pluggable electronic package according to claim 3 characterized in that said first (43) and said second (42) locking means are first (43) and second (42) tooth elements mounted on each of said arms (40), said first tooth elements (43) being positioned with respect to its associated arm (40) so that, upon clockwise rotation of said lever (38) around said studs (41), to penetrate into first associated apertures (45) formed within the top face of said top cover (33); said second tooth element (42) leaving second associated apertures (45).

5. Machine-pluggable electronic package according to claim 4 and characterized in that said tooth elements (42,43) are adapted to engage edge portions of a transversally extending rail element (51).

6. Machine-pluggable electronic package according to any one of claim 1 to 5 characterized in that said handle (39) is positioned so as to prevent said lever (38) from rotating to said second direction as long as said outside conductor means is connected to said second connector means (35).

7. Machine-pluggable electronic package according to claim 6 characterized in that said handle (39) includes at least one appendage, whose size is dependant on the size of said outside conductor means.

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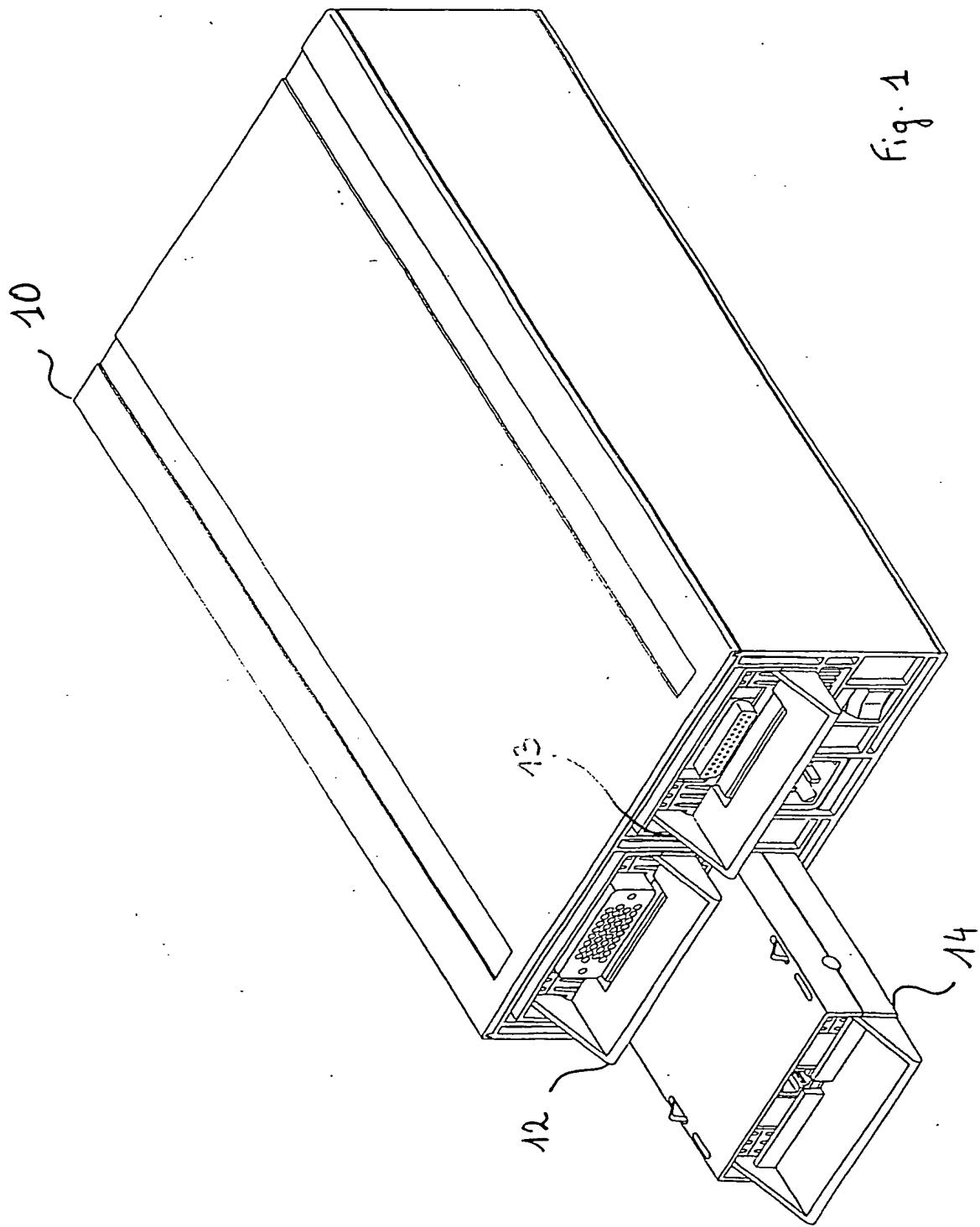


Fig. 1

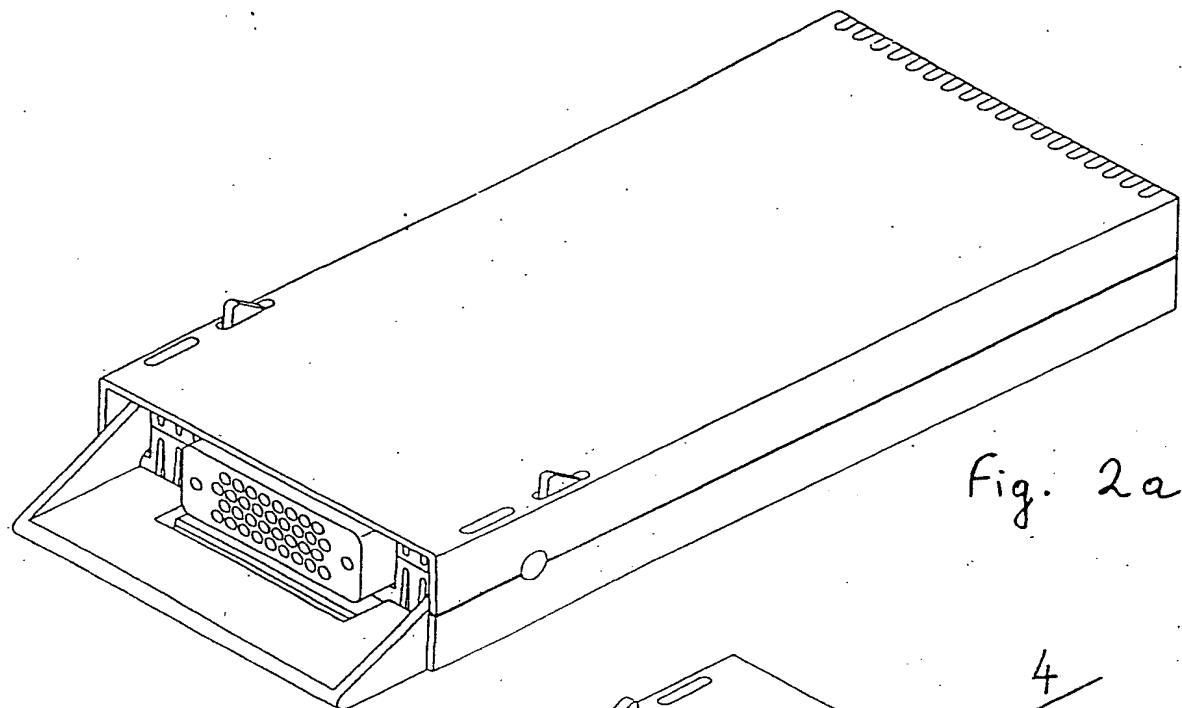


Fig. 2a

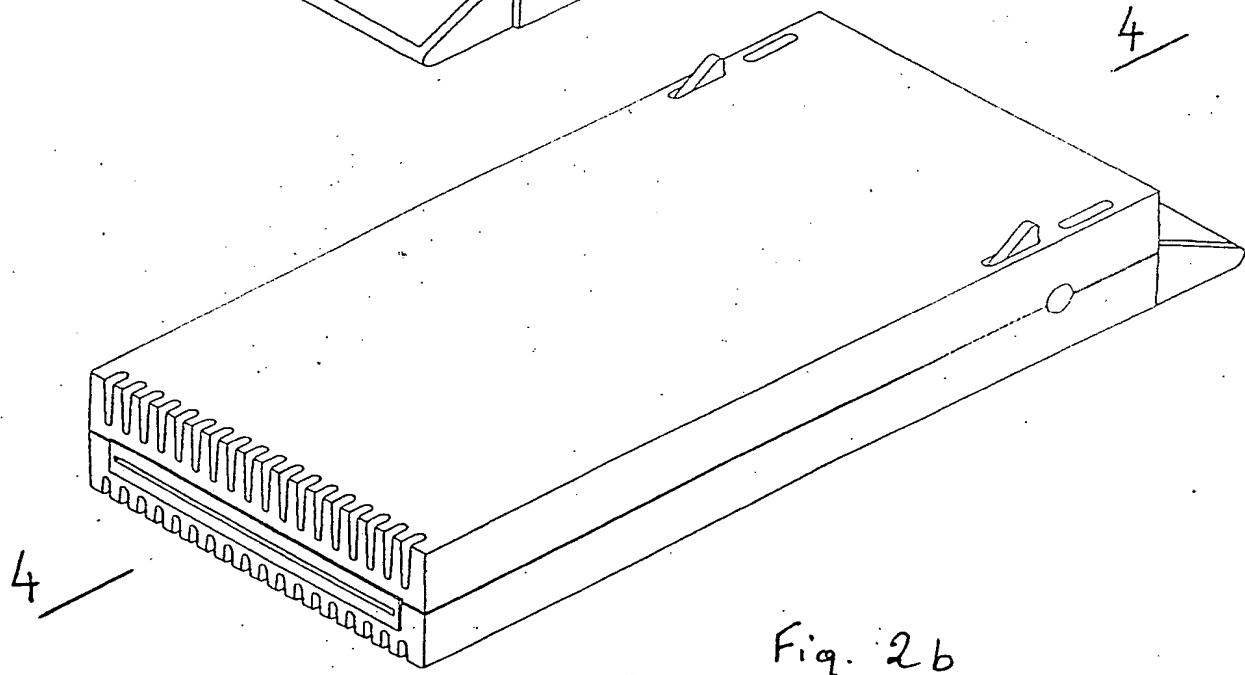


Fig. 2b

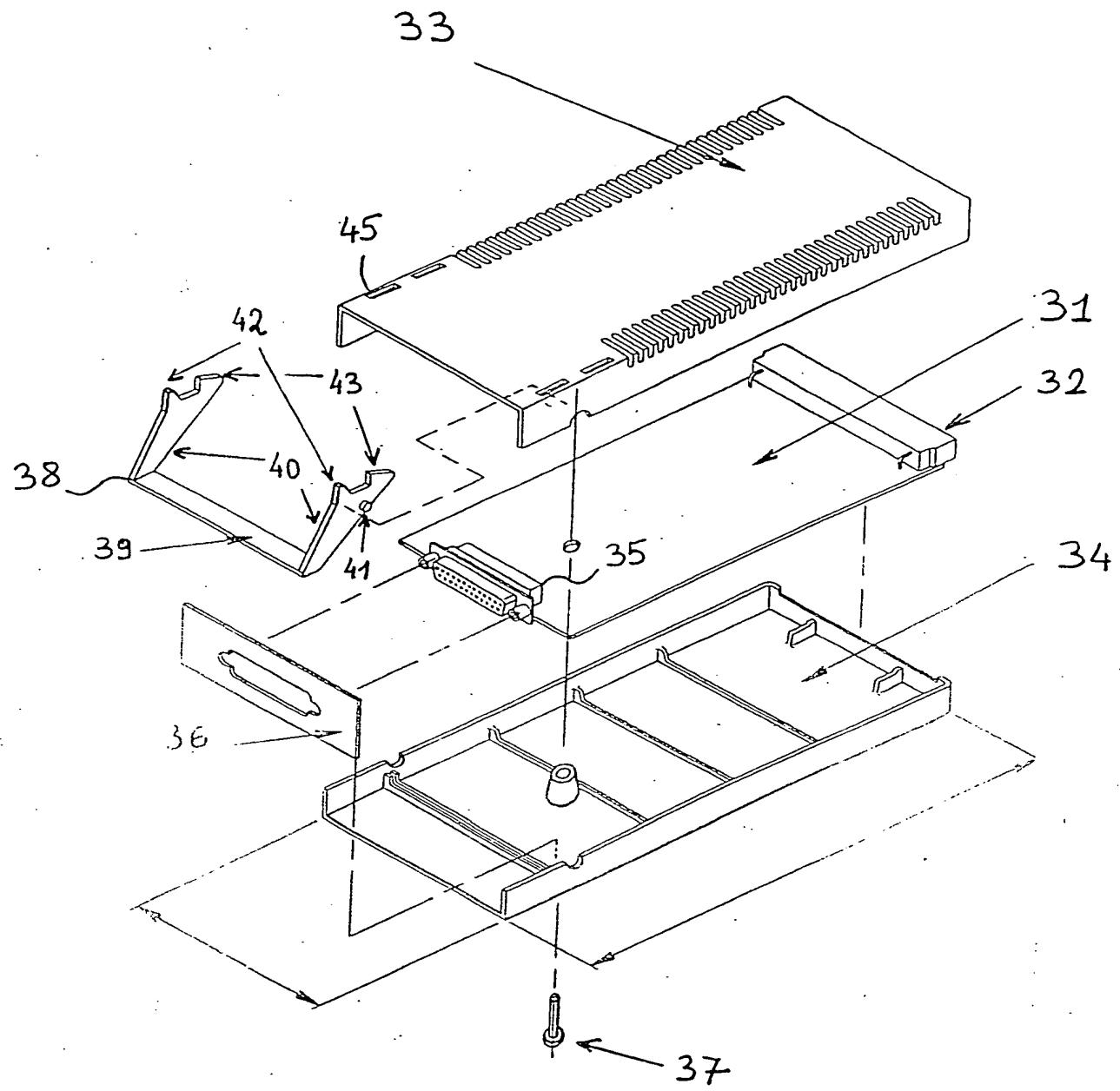


Fig. 3

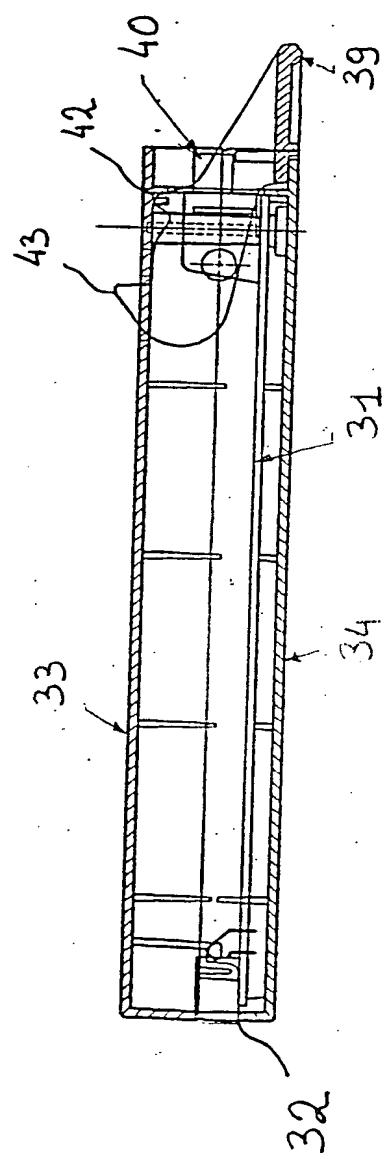


Fig. 4

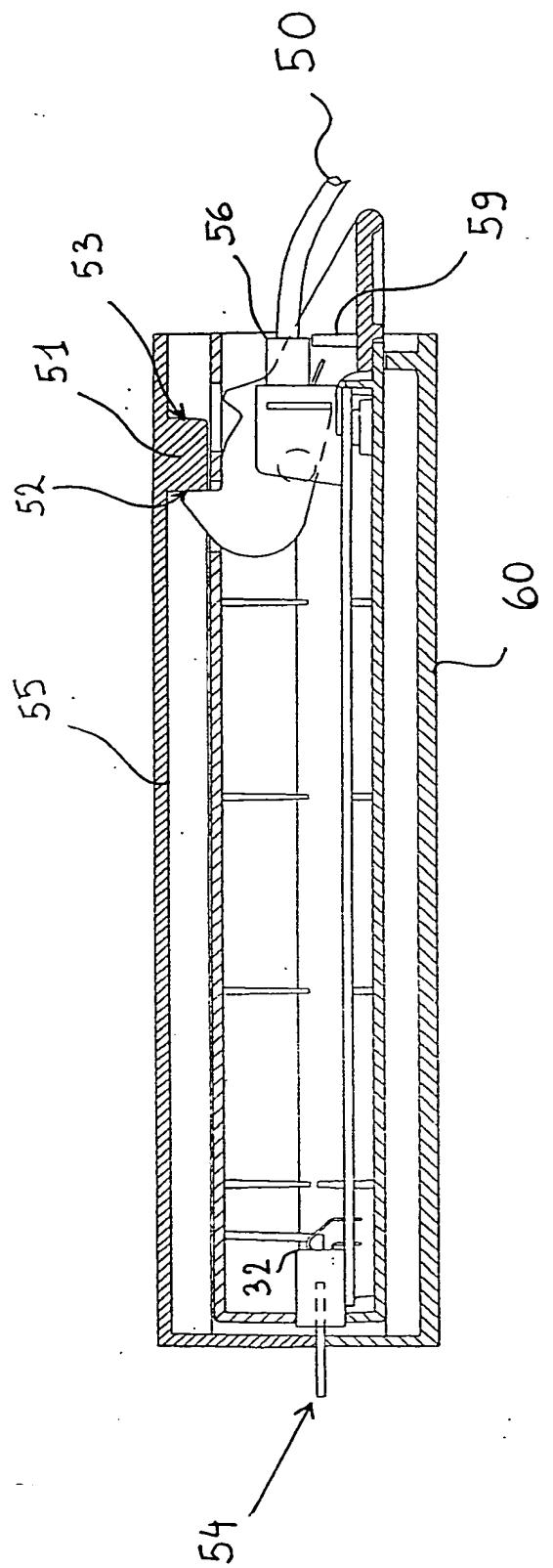


Fig. 5



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X	EP-A-0 167 667 (SIEMENS) * figures 1,2; page 2, line 17 - page 6, line 3 *	1,2,5-7	H 05 K 7/14
X	DE-U-8 620 241 (EBERLE) * figures 1-4; claims 1-9 *	1,2,4-6	
A	US-A-4 301 494 (JORDAN) * figures 1,5,6; column 5, line 36 - column 6, line 42 *	1,2,5	
A,D	EP-A-0 176 676 (IBM) * whole document *	1	
A,D	IBM TECHNICAL DISCLOSURE BULLETIN volume 27, no. 6, November 1984, New York, US, pages 3536-3538; G.J. CLAIR: "Lever-secured pluggable circuit card enclosure" * whole document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)			
H 05 K 7/00 H 05 K 5/00			
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
BERLIN	20-10-1988	HAHN G	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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